

Ninth Monthly Report of the MI BPM Upgrade
March, 2006
wbs item 1.1.3.2 of the Run 2 Luminosity Upgrade Project
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Project Definition:

The MI BPM Upgrade will replace the current BPM electronics and the data acquisition system used to transfer information between the BPMs and the Accelerator Controls Systems. As part of the project, the software used to read out, transfer, store, and analyze the BPM data will be upgraded. The goal of the project is to provide a BPM system based on modern hardware and software that gives the higher resolution and expanded functionality necessary to efficiently understand and operate the Main Injector now and for the foreseeable future including the needs for Run 2 and NUMI. Deliverables of the project include all relevant documentation, manuals, user's guides and any other written records necessary for maintaining the system.

Project Manager's Summary:

The 2006 accelerator shutdown began in late February. The Main Injector BPM upgrade project is taking advantage of the shutdown to perform work in the Main Injector tunnel, partially in response to behavior that was seen with the MI40 upgraded system. The project continues to work on many aspects of the upgrade, with the goal of installing the entire system as quickly as possible after beam returns in late May.

A large effort in March went into measuring the relevant characteristics of the cable (nominally RG8 foam) that connect the combiner boxes in the MI tunnel to the service buildings (MI10, 20, 30, 40, 50, 60S and 60N). Ideally, these cables would be matched both in phase and in attenuation. The position measurements from the MI40 upgraded BPM electronics showed large offsets (a few mm) for some of the BPMs. One hypothesis to explain the offsets was that the cables were not matched. Peter Prieto, Marv Olson, Bob Dysert, John Van Bogaert, John Seraphin, and Bill Barker as well as Bob Webber spent time making measurements of the cable characteristics and they continue to analyze the data to get a better understanding of the situation. At this time it is known that many of the cable pairs are in fact not very well matched and that we can and will correct for that mismatch by using the measurements that were made.

The remaining combiner boards were installed in the tunnel during March. The combiner boards for the new quads will be installed as the quads go into the tunnel. Any necessary cabling will be done to connect the new BPMs attached to those quads to the combiner boards. Some cables will be pulled to bring the signals from the tunnel to the appropriate service buildings.

During the early part of March we discussed, along with the Jonathan Lewis and Ioanis Kourbanis, some scenarios for BPM and BLM electronics installation and commissioning

for the Main Injector. The two are tied together due to rack space issues as well as the fact that the old readout system is shared for the two systems. Given that there are many changes in the Booster, MI, and transfer lines, as well as some uncertainties in the BPM and BLM schedules, we agreed to discuss this issue again as more is known about the progress of the shutdown and the hardware and software for the upgraded BLM and BPM instrumentation systems.

The hardware acquisitions continue and are still on track. All of the cables were delivered in March. The purchase order for the transition boards was completed in early March and the first 3 boards are expected in early April. The transition board controller card is on schedule. Backplanes and air dams were all ordered. Some small purchases remain but essentially all hardware for the project is either in hand or is on the way.

The software for the upgraded BPMs is effectively completed. Some functionality is being added as necessary. Alarms are being added. Separate corrections to A/B (or an offset) for 2.5 MHz and 53 MHz measurements will be implemented.

Three abstracts to the Beams Instrumentation Workshop 2006 were submitted. One covered the front end analog system, one the front end software and the third the upgrade as a whole.

Rob Kutschke will give a talk about the MI BPM upgrade at the April 3, 2006 All Experimenters Meeting.

Resources Used in March 2006:

The total time worked on the project in March 2006 from the Computing Division was 4.2 FTE-months with 14 people contributing. The time worked from the Accelerator Division was 3.0 FTE-months with 11 people contributing. The total time worked from both Divisions was 7.2 FTE-months. The following table gives the estimated or reported effort for both divisions (in FTE-months) since July, 2005.

Month	AD Effort	CD Effort	Total Effort
July, 2005	2.1	2.4	4.5
August, 2005	1.4	2.7	4.1
September, 2005	2.8	3.7	6.5
October, 2005	3.5	4.7	8.2
November, 2005	2.1	5.1	7.2
December, 2005	1.4	5.7	7.1
January, 2006	3.1	4.1	7.2
February, 2006	4.2	5.7	9.9
March, 2006	3.0	4.2	7.2
SUM (through Mar, 2006)	23.6	38.3	61.9

The effort listed here is time worked and does not include vacation, sick leave, holidays, etc.

Purchase requisitions/procard obligations through March, 2006:

The purchase order for the Transition Modules was placed on March 3, 2006. Other hardware purchases in March include the backplanes for the Transition Module crates and the air dams for the system.

Milestones:

1.1.3.2.1.2	MI BPM: Review (Milestone)	7/25/2005
1.1.3.2.4.2	All Combiner boxes available	10/25/2005
1.1.3.2.3.1.3.5	Transition module PO issued	1/10/2006
1.1.3.2.6	MI BPM system complete	8/15/2006

The PO for the transition module was placed on March 3, 2006.

Meetings held, Reports Given:

Meetings were held in March on the following dates:

Project Meetings: March 7, 14, 21, 28 : Minutes beams-doc-1526

Documents:

The following documents were written and added to the Accelerator Division Document Database during March, 2006.

[1526-v5 MI BPM Meeting Notes and Minutes Steve Wolbers](#) 03 Apr 2006

[1951-v1 Monthly Report of the MI BPM Upgrade Project Bakul Banerjee et. al.](#) 28 Mar 2006

[2217-v1 Main Injector Beam Position Monitor Upgrade: Status and Plans Robert K Kutschke](#) 28 Mar 2006

[1949-v8 Main Injector Beam Position Monitor Upgrade Software Specifications for Data Acquisition Steve Foulkes et. al.](#) 24 Mar 2006

[2203-v1 Update on Performance of MI BPM Upgrade Robert K Kutschke](#) 14 Mar 2006

Subproject Leaders Reports:

Rob Kutschke: Validation

During the months of February and March the data validation effort continued as many new data sets were acquired from the single BPM under test and from the prototype house, 11 BPMs, installed in MI40. For protons, all major operating modes of the system have been demonstrated: closed orbit, turn by turn, safe mode and raw data mode. For anti-protons the first two of these have also been demonstrated. While inspecting this data, a number of small problems were discovered and promptly fixed by changes to the daq software.

I led a discussion on the structure of timing parameters needed to operate the full system. One result of this discussion was the addition of a new delay set of delay parameters that depend on whether the measurement is timed relative to the BES signal or the MI \$AA marker. This has been implemented. A second result was understanding the design of the user interface for dealing with injections that come from different injection lines; the answer is that the user interface will always request an MI bucket number at which to start the measurement, regardless of the injection line.

When the MI BPM pickups were built, a pulsed wire system was used to measure the response of the BPM as the wire was scanned across the aperture. I have started the analysis of this data to determine if two polynomials, one for horizontal measuring BPMs and one for vertically measuring BPMs is an adequate description of the pickups. This work is still underway.

I also prepared a summary of the project so far that was presented at the All Experimenters' meeting on April 3.